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| **Science Second 2. Earth and Space Science 2. Observe and record the recognizable objects and patterns in the night sky. (4 weeks)**  **Content Big Ideas Standard 1 Big Ideas – Intended Learning Outcomes Science, Technology, and Society Big Ideas**  (S) There are recognizable patterns among objects in the night sky.  **Indicators: Measureable Outcomes framed by Standard 1 Big Ideas**  **Indicator 1. Observe, describe, and record patterns in the appearance and apparent motion of the moon in the night sky.**  **Indicator 2. Observe and describe the number, arrangement and color/brightness of stars in the night sky.**  **Science language students should be able to use correctly:** arrangement, patterns, location, variations, constellations, moon phases.  **Guidance for Combining Content and Process**  **Suggested Strategies**  During a time when the moon is visible at night, students can keep a nightly journal recording the appearance and  location of the moon in the sky for one week. The product can be the journal and reflective  discussion/writings/opinions.  Students can make an observation of the night sky to record the estimated number of stars, the apparent  color/brightness of the stars and the arrangement of stars in the sky. After making observations, students can discuss  findings in groups and develop their conclusions about the patterns and variations of the stars in the sky.  Students can use magnifiers (e.g. binoculars, telescopes) to help see things they could not see without them.  Students can explain how objects in the night sky are used for navigation (e.g. GPS, north star, star patterns).  Students can understand that space exploration has produced data to answer questions about the moon and stars.  Students can evaluate factors in the environment that might limit viewing of the night sky. |
| **Lesson 1. Learning about the Moon**  Engage and Activate Prior Knowledge  **Important Understandings:**  The Solar System is immense.  Know time Space relation of Earth-Moon’s position in Solar System  Know Earth-Moon’s position in Solar System  Know Earth is only small part of Solar System  The Solar System is interactive.  Know that earth revolves around the Sun and Moon revolves around earth.   * Would you like to go to the moon? Why or why not? * If you went to the moon, who would you take with you? * What do you think it would be like if we had two moons? How could we tell * them apart? * Read the following facts about the moon and its phases. * The facts are grouped in lists of five facts. Within each * group, have the child rank the facts from 1 to 5 in order of * most to least important to know, with 1 being most * important and 5 being the least. * After the facts are ranked, have the child put a star next to the facts he or she knew before reading the list.   **Fact Rank**   * The moon has many names; for instance, the Romans called it Luna. * The moon does not make its own light. It can only reflect light. We see the light reflected off of the moon from the sun. * The moon has no atmosphere, so it doesn’t have weather. There is no wind on the moon. Because of this, the footprints on the moon left by the astronauts will stay for millions of years. * The moon is about 4.5 billion years old. * The moon is orbiting around the earth at the speed of 2, 288 miles (3,683 kilometers) per hour.   **Fact Rank**   * The surface of the moon isn’t flat. It has lots of craters. They were formed by meteorites hitting the moon. * The moon also has mountains and valleys. * The moon moves across our sky toward the east. * The moon is 250,000 miles from earth. * The moon takes 27 days, 7 hours, 43 minutes and 11.6 seconds to orbit the earth.   **Fact Rank**   * The part of the moon we can see changes. We call these changes the phases of the moon. * The phases of the moon are caused by its orbit around the earth. * The first phase of the moon is called the new moon. That is when you cannot see the moon from earth at all. * If you have thirteen full moons in a tropical year (winter solstice to winter solstice, the extra one is called a blue moon. * It takes the moon about 29 ½ days to go through all its phases. We call this a lunar month.   **Historical Perspective** Show the students drawings of the phases of the moon made by Galileo. |
| **Lesson 2. Introduce Moon Craters and Reflected Light**  **Major Understanding: Moons are seen by reflected light.**  During a time when the moon is visible at night, students can keep a nightly journal recording the appearance and  location of the moon in the sky for one week. The product can be the journal and reflective  discussion/writings/opinions.  o Explain that moon craters are different sizes. They are usually shaped like circles  with the middle sunken in and the edges high.  o Ask why the child thinks the moon would be hit by more meteors than the earth.  (The moon has no atmosphere to protect it, while the earth does.)  o Show pictures of craters of the moon so the child develops a feel for how many  there are. You can also explore the moon at <http://earth.google.com/moon/>.  **Moon Crater Art Project**   * Materials: watercolor paint, white cardstock or construction paper, paintbrush, white glue * Cut the cardstock or construction paper into a circle as large as the paper will allow. (You may use the circle pattern at the end of the lesson.) * Have the child draw craters within the circle with pencil. * Use the glue to “draw” over the lines. * When the glue is dry (or at least mostly dry), use watercolor paint to paint the moon. Using blues, greens, and purples will imitate the idea of the blue moon.   **http://i3.squidoocdn.com/resize/squidoo_images/-1/lens17472391_1300816193DSC03813-1.JPG**  Create the moon's surface. Cover an area with newspapers as this will get flour everywhere. Give each child a cake pan with about 2 cups of flour (surface of the moon) in it and 3 small balls of different sizes (meteorites). Ask them what each item represents. Let them drop the balls in the flour and create craters. Ask them if this is what the Earth looks like and why. The moon has no atmosphere. God protected our planet with an atmosphere to burn up meteorites as they blast onto our planet. YOU WILL NEED: flour, 27 balls of various sizes  [type=text](http://www.squidoo.com/type=text)(OPTIONAL) Show a photograph of the moon's surface and a picture of a moon rock. Pass around a piece of basalt and explain how this igneous rock is very similar to what moon rocks look like.  YOU WILL NEED: 1 piece of basalt |
| **ACTIVITY: EARTH-MOON SYSTEM**  Bring in beach balls for the Sun, baseballs for the Earth, and ping pong balls for the  Moon. Have students in groups of four. Make sure the groups consist of different levels  of students. Have on student in each group act as the Sun and hold the beach ball above  their heads. Then have another student in each group act as the Earth and hold the  baseball above their heads. They are to stand a little bit of a distance from the Sun, and  they are to SLOWLY turn as they **revolve** around the Sun. Have another student from  each group act as the Moon and hold the ping pong ball above their heads. They should  stand close to the Earth and only make one **rotation** as they **revolve** around the Earth.  This means that they should always face the earth, since only one side of the moon ever  faces the Earth. Have another student from each group observe and record what they see.  After the activity is completed, have the students reflect on the activity, what they have  learned, what they are curious to learn more about, and/or any creative thoughts this  activity may have inspired them to write. This is their journal, so it is the studentÕs  choice what he/she wishes to write. They can do this in a “Space Journal” that will be  written in at the end of every activity. |
| **Lesson 3. Our Moon orbits Earth, while Earth orbits the Sun.**  Act out revolving. Place a lamp (turned on) in the middle of the room. Have everyone stand in a circle around the lamp. Have them walk counterclockwise around the lamp and ask how long it takes the earth to revolve around the sun.  **Explain and Connect:** Use models of the Sun, earth and moon to explain: The reason for day and night on earth. The time for one earth rotation (24 hours) The time for one moon orbit (29 ½ days) The time for one moon rotation (29 ½ days) The “far side” of the moon. Connect the use of these models to the opening activity on perspective.  **Demonstration** Walk around a chair or desk and keep facing it while you circle it to illustrate how the moon always “shows” one side to the earth.  **Activity** “What about my perspective?” Ask students to think in terms of differing perspective by finding their right hand vs the hand to their neighbor’s right. |
| **Lesson 4. Introduce Moon Phases**  **The Moon’s phases as observed from Earth are the result of seeing different portions of the lighted area of the Moon’s surface.** Know that the moon is always a round sphere but that we only see the parts of it that the Sun is reflecting off of.  Moon Reflecting the Sun's Light  **[type=text](http://www.squidoo.com/type=text)** Show how the moon reflects the light of sun & how phases are made. Give each child a ball (I used tennis balls.) and a piece of aluminum foil. Have them wrap the ball with the foil. This is your moon. Have them each grab their flashlight. Go to the darkest room in the school. Turn off the lights. Can they see their moon? (No.) Now have them each turn on their flashlights (the sun). Can they see their moon now? (Yes.) What did this show them? (The moon shines because it reflects the light of the moon.) Have all but 1 child turn off their flashlight. Use a ball (the Earth) & have it slowly move between the light from the flashlight & the moon. Watch how on parts of the moon are illuminated. This is what causes lunar phases. Yes, the complete moon is always there, but you can only see parts of it because the Earth gets between some of the rays of sunshine and the moon.  YOU WILL NEED: 10 balls (like 9 tennis balls & 1 soccer ball) & aluminum foil  Watch these two short videos on the phases of the moon:   * http://www.youtube.com/watch?v=mZNfZJZs3R8&feature=related * http://www.youtube.com/watch?v=2aFGNGEcDOk&feature=related * Match the name description of the moon phase to the picture. (See sheet below.) Only four of the eight phases are on the chart. If the child is interested in all eight phases, have him or her describe the other phases and draw pictures of them. *Hint:* in the northern hemisphere, the waxing moon is on our right side, so the picture at right is of a waning * moon and the picture below is of a waxing moon. * Go to the following Web site and have the child find the phase of the moon when he/she was born: http://tycho.usno.navy.mil/vphase.html   **Chart the Moon Phases**   * Use the printable moon phases calendar at the end of this lesson section. * Every night for a month, have the child shade in what part of the moon he/she * can see. * After the month, see how many of the phases of the moon the child can identify. * Have the child play the matching game on the next page.   **Indicator 1. Observe, describe, and record patterns in the appearance and apparent motion of the moon in the night sky.**  **Establish Framework for Development of Scientific Vocabulary** Define “waxing” and “waning”.  Ask students to describe which direction the light moves across the moon. Ask students to determine how much time the moon is waxing. …waning  **Reinforce and Assess** Activity – “Patterns of Moonlight” Give the students a set of images of various phases of the moon. Ask them to put the images in chronological order. Assess the student understanding and adjust the lesson accordingly.  The pictures don’t match the moon phase! Help the moon find its phase by drawing a line from the description to the correct picture of the moon phase.   * New Moon: The moon is all dark because the lit-up half is facing away from earth * Quarter Moon: A week after the New Moon, we can see half of the half that shows, so ¼ of the moon * Full Moon: Two weeks after the New Moon, we can see the entire lit-up half of the moon. * Last Quarter (or Third Quarter) Moon: Three weeks after the New Moon, we can see half of the lit-up part again. It’s the other half than we saw before.   Repeatedly show a movie of the changing phases of the moon from NASA satellite images. Ask students to write down at least 5 words they associate with the movie of the moon. Ask students about the source of moonlight.  Oreo Lunar Phases  [type=text](http://www.squidoo.com/type=text)  Show the various lunar phases by showing the cut outs in Faces of the Moon by Bob Crelin. Use the handouts created for this activity. Create [the moon's phases using Oreo cookies](http://analyzer.depaul.edu/paperplate/Oreo%20Moon%20Phases.htm) and then eat cookies & drink water. Review what we've learned so far as they eat the cookies. YOU WILL NEED: 2 packages Oreo-type cookies, 25 copies of the moon phases Oreo sheet from [The Moon's Phases Using Oreo Cookies](http://analyzer.depaul.edu/paperplate/Oreo%20Moon%20Phases.htm) , 25 plastic knives or spoons, 25napkins, 25 cups for water |
| **Lesson 5. The phases repeat in a cyclical pattern in about one month.**  Define Terminology and Connect Give students the basic definitions for new moon, full moon, crescent moon, quarter moon and gibbous moon.  Ask students to also remember the definitions of “waxing” and “waning”  Explore Activity –“Phases of the Moon Lab”. Let the students explore phases of the moon by letting them experiment with models of the moon, and a light source.  Reinforce concepts of perspective, and cyclical patterns. Scaffold the exercise with a worksheet that includes vocabulary for phase names. |
| Lesson 6. How do lunar and solar eclipses take place, and why are they not more common?  Read Eclipse: Darkness in Daytime by Franklyn Mansfield Branley.  Half way through the book have the children look out the window at a [tree](http://www.squidoo.com/the-sun-and-the-moon-lesson-plan-in-homeschool-astronomy-unit-). Close one eye. Hold up one finger and position it so that you can't see the tree. Ask, "Did the tree disappear? Why did it appear to no longer be there?" Your finger (smaller than the tree) was able to block out the tree because it's closer to you. The moon is closer to us so it is able to block out the enormous sun during an eclipse.  Show a picture of a lunar eclipse and discuss the one we saw in December 2010. (It turns red because the sun's light passes through the atmosphere of the Earth...kind of like at sunrise and sunset.) |
| Why are the Earth and the Moon considered a system?  The Solar System is constantly changing.  Know that the Earth-Moon System is always moving around the Sun, just like the other planets and their moons are always moving around the Sun.  Know that the Earth is always moving around the Sun, and that the moon is always moving around the Earth.  Know why the phases of the moon occur and solar and lunar eclipses.  Sing Day, Night, & Year song. (Tune: " The Farmer in the Dell") The Earth rotates around, (Spin around in place) The Earth rotates around, Once a day, in 24 hours, (Tap wrist like you're tapping a watch) The Earth rotates around.  The moon rotates 'round the Earth, (Hold up 1 finger & spin around in place) The moon rotates 'round the Earth, Once a month, 29 days, (Tap wrist like you're tapping a watch) The moon rotates 'round the Earth.  The Earth revolves 'round the sun, (Hold out one finger & wave around in a large circle) The Earth revolves 'round the sun, Once a year, 365 days, (Tap wrist like you're tapping a watch) The Earth revolves 'round the sun. |
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| **Explain daily, monthly and seasonal changes on the Earth.**  Know the phases of the moon. Also how the moon affects tides on Earth.  Know why Earth revolves around Sun, and moon revolves around Earth.  Know about the seasons. Be able to name the seasons and tell what weather is like where they live during those seasons.  Also how the moon affects tides on Earth.  **ACTIVITY: SEASONS**  Have one student holding the beach ball as the Sun. Use another globe made by one of  the students in this activity. Have that student model the seasons. Have the student tilt  the axis (wooden peg) of his/her Earth and tell the student to keep it tilted that way at all  times. Demonstrate that sometimes the top peg (the North Pole) is tilted towards the Sun,  while the bottom peg (the South Pole) is tilted away. This means that the Northern  Hemisphere is experiencing summer while at the same time; the Southern Hemisphere is  experiencing winter. Explain that this is because the Northern Hemisphere is receiving  more direct sunlight because it is tilted toward the Sun. Ask them if anyone has noticed  that the Sun seems to be higher in the sky at noon in the summer than it is in the summer.  (EMPHASIZE THE FACT THAT STUDENTS SHOULD **NEVER** LOOK DIRECTLY  INTO THE SUN!) Ask them why they think that is. Also have the student demonstrate  the globe on the other side of the Sun; Where the Northern Hemisphere is tilted away  from the Sun while the Southern Hemisphere is tilted toward the Sun. Have the student  move the globe a quarter of the way around the Sun so the axis is not tilted toward the  Sun at all and explain spring and fall. Explain that the Earth makes a complete revolution  around the Sun. One revolution takes 1 year and that is why there are four seasons.  Have the students get into groups of multi-levels with one globe per group. Have one  student in each group act as the Sun and another student move the globe around the  “Sun” always tilting the same way. The other students in the group have to say which  season it is in the Northern Hemisphere. While the group activity is taking place, have  instrumental seasonal music playing softly in the background.  At the end of the activity, have the students reflect on the activity in their Space Journals.  **Multi-Level Strategies:**  Advanced students can determine when the spring and winter equinoxes are and why  they fall on the dates they fall on.  The students can learn at a variety of levels in this activity, some only realizing what the  different seasons are and what the weather is like in those seasons, and some  understanding the entire concept of the earths revolution around the sun and how that  affects the Earth’s seasons along with the tilt of the Earth’s axis. |
| **Gravity (2 weeks)**  **Gravity (myuen.org)**  **Summary:** The students will experiment with various objects observing how gravity affects the objects. Students will test the effects of gravity on themselves and other objects.  **Main Curriculum Tie:**  Science - 2nd Grade [Standard 3 Objective 1](http://www.uen.org/core/core.do?courseNum=3020#38887) Communicate observations about falling objects.  [Supplemental Materials](http://www.uen.org/core/science/downloads/Supplemental_2_3_1.pdf) (pdf)  **Materials:**   * Classroom items: paper, pencils, books, etc. * [Looney Tunes Clip](http://www.spike.com/video-clips/eo7zu8/looney-tunes-coyote-canyon-dive) * Unsharpened pencils for every student * [*Gravity* Page](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-2-34943-gravity.pdf&filename=gravity.pdf) (pdf) * [*Falling Objects* paper](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-2-34944-falling.pdf&filename=falling.pdf) (pdf) * Ping pong balls, marbles, paper, feathers, pencils, paper clips, erasers * Science journals * Meter sticks * Masking tape * [*How High Can You Jump?* paper](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-2-34945-how-high.pdf&filename=how-high.pdf) (pdf)   **Books:**   * *Forces Make Things Move*, by Kimberly Brubaker Bradley, ISBN: 0‐06‐028907‐4 * *Why Don't Things Fall Up?*, by Disney, ISBN: 1‐57973‐143‐0 * *Waking Upside Down*, by Philip Heckman, ISBN: 0‐689‐31930‐4 * *The Science of Gravity*, by Science World, ISBN: 0‐7398‐1323‐4 * *I Fall Down*, by Vicki Cobb, ISBN: 0‐688‐17843‐X   **Media:**   * *Bill Nye the Science Guy: Gravity*; Disney; ISBN 1932644954 * *School House Rock, Science Rock: A Victim of Gravity*; Disney; ISBN 0‐7888‐2925‐4   **Attachments**   * [gravity.pdf](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-2-34943-gravity.pdf&filename=gravity.pdf) * [falling.pdf](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-2-34944-falling.pdf&filename=falling.pdf) * [how-high.pdf](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-2-34945-how-high.pdf&filename=how-high.pdf)   **Web Sites**   * [Nye Tunes Gravity](http://www1.teachertube.com/viewVideo.php?video_id=126337&title=Nye_Tunes_GRAVIT) * [Bill Nye on Gravity](http://www1.teachertube.com/viewVideo.php?video_id=126336&title=Bill_Nye_on_Gravity) * [Science NetLinks](http://www.sciencenetlinks.com/lessons.php?BenchmarkID=4&DocID=158)   **Background For Teachers:** When you throw an object in the air, you exert a force that causes it to fly. It continues to fly until the effects of gravity become stronger than the force you used. Gravity pulls the object back toward Earth. Gravity is strong and pulls objects without touching them. Gravity is always working. It is a constant force, which means it never stops! The farther an object falls, the faster gravity makes it travel. Gravity can work in our favor; when we ride a bike down a hill, we go faster and faster as we near the bottom. Gravity can also work against us; when we ride a bike up a hill and it becomes more difficult to pedal.  Very light objects, such as feathers or seeds, fall slowly or even seem to float in the air. They are so light that air can hold them up against the force of gravity. Air and air resistance can cause objects to fall slowly to the ground. Air can slow an object, but it can’t stop gravity.  A common misconception is that heavier or larger objects will fall faster than objects that are smaller or lighter.  **Intended Learning Outcomes:** (P) When science investigation is done the way it was done before, we expect to get a very similar result. (N) Sometimes people aren’t sure what will happen because they don’t know everything that might be having an effect. (C) In doing science, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.  **Instructional Procedures:** **Invitation to Learn:**   * Ask: "If I dropped a basketball and a marble at the same time, which one would hit the ground first?" Students will make a prediction. "Why did you choose that answer?" * Drop both items from a high vantage point. Allow students to observe and record their observations in their science journals. * Repeat the experiment three more times to model good experimentation. * Make a comment such as, "That was odd, don't you think? The basketball is heavier than the marble, isn't it?" * Think aloud about this question. Then tell the students, "I think this is something we need to experiment with and try with other objects in our groups."   **Instructional Procedures:**  **Why Things Fall**   * Choose several items from your classroom (paper, pens, pencils, books, etc.) and drop them. * Pick up an unsharpened pencil. * Ask: "What will happen if you drop it?" (It will fall) "Which direction will it fall?" (Down) "Are you sure?" * Do not drop the pencil at this point. * Play the Looney Tunes video clip (see Lesson Materials) of the coyote chasing the roadrunner and defying gravity. Discuss with students if they think that this is something that could really happen or not. * Give every student a new, unsharpened pencil. Have them pick up their pencils, hold them out in front of their body and let go. * Ask: "What happened? Why?" * Ask: "What is gravity?" * As a class, come up with a good definition of gravity. Have students record their definition on their *Gravity* page. * Ask: "If gravity is pulling us toward Earth, why can we still walk around and jump into the air?" (We can temporarily overcome the effects of gravity.) * On the *Gravity* page, have the students make a list of things that can fall to the Earth. (Rain, snow, leaves, stars, a ball thrown in the air, etc.) * Create a class list from the ideas of the students. * Ask: "Are there any items on our list that might never fall all the way to Earth? Why?" Discuss student answers as a class. * Ask: "What are some of the reasons why things may not fall to Earth?" (Landing on another object such as your hand or a house; meteorites: the atmosphere stops/slows them) * Ask:" Are there things that slow the rate at which things fall to the Earth?" (Air) * Assign students the task of watching for falling objects in the world around them. Have them to name the item and what they saw when the item was falling. "Was there anything that kept the item from reaching the ground? Did the item fall fast or slow?" Students can report back to the class about the falling items they found.   **Falling Objects**   * Divide students into small groups of two to four. * Hand each group a *Falling Objects* paper and the materials needed to complete the experiment (see Lesson Materials). * Allow students to work in their groups for 10‐15 minutes to complete the experiment. * Students should record their data collection on the *Falling Objects* paper. * Answer any questions that arise as you help the groups experiment. * Have students share the information they collected during the experiment. * Create a class chart of the findings from each group. Make the *Falling Objects* paper poster size to make the chart. * Students will discover that objects similar in shape, but with different weights, hit the ground at the same time. However, they will also discover that the unfolded sheet of paper will hit the ground later than the ping pong ball. Or perhaps the feather will fall much slower than the marble. * Lead students to the knowledge that mass does not affect the rate at which objects fall, but shape definitely makes a difference. * Ask: "Does gravity change?" (No. Gravity remains constant. Shape changes; gravity does not). * Ask: "Why is it important to know about gravity?" Help students discover that without gravity we would fly off the earth. Gravity helps us understand how things move around us in our physical world. * In their science journal, have students write a paragraph that states three important things they have learned about gravity from this experiment. (Objects similar in shape but with different weights will hit the ground at the same time.)   **How High Can You Jump?**   * Ask: "How high do you think you can jump?" * Show students the meter sticks and have them guess how high they can jump. * Ask: "Will holding a weight affect how high you can jump?" * Tell students that they are going to find out the answer to these questions in the experiment they are about to do. * Prior to starting this experiment, tape a meter stick to the wall with zero down at the floor. * Each student needs a partner to watch his or her jump. They will need to record their jumps on the *How High Can You Jump* paper. * Each student should jump at least three times while his/her partner records his/her results. * The observing student should sit on the floor and watch the bottom of the feet of the jumping student. The height of the bottom of the feet is the height that should be recorded. * Next, students should hold small weights in their hands while they jump. Two, three, and five‐pound weights would be ideal. * Students hold one weight in their hand while they jump. * Students will follow the same observation guidelines as with the non‐weight jumps. * Students will change places so that every student gets a chance to jump. * Finish this activity by asking students to record their results and observations in their science journal. * Have students write a paragraph stating how jumping with weights was different than jumping without them.   **Lesson and Activity Time Schedule:**   * Each lesson is 55 minutes. * Each activity is 30 minutes. * Total lesson and activity time is 85 minutes.   **Activity Connected to Lesson:**  **Gravity Test**   * Make a ramp with a slight tilt. A binder will work well for this. * Take two marbles of different sizes and line them up at the top of the ramp. * Use a ruler to act as a gate which will hold the marbles in place at the top of the ramp. * Lift the ruler (gate) quickly so the marbles release at the same time. * Watch the finish line closely to see which marble comes in first (or if it is a tie). * Keep a sharp eye out for the winner. Complete the race 4‐5 times for accuracy. * Have students record their findings on the [*Testing Gravity* page](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-6-34946-testing-gravity.pdf&filename=testing-gravity.pdf) (pdf).   **Airplane Contest**   * The students should have a pre‐made airplane at school (see Family Connections). * Have one student at a time fly his/her airplane. This is best done in a hall with a tile floor. If that is not an option, tape can be placed on the floor as the optimal line of flight. * Record the results as students fly their planes. To determine each student's result, count how many tiles away from the starting line, then subtract the number of tiles off course (to the left or right). * If using a tape line, measure the distance from the starting line and subtract the distance from the line of flight (to the left or right). * Analyze which airplanes were the most successful in meeting the criteria and why. * Are there some variables in the experiment that could influence the results? How could we control those variables?   **Activity Materials:**   * Marbles * Binders * Rulers * Science Journals * Paper for airplanes * Recording sheet (student class list) * Masking tape * Measuring tape or ruler/yardstick   **Attachments**   * [testing-gravity.pdf](http://www.uen.org/Lessonplan/downloadFile.cgi?file=28207-6-34946-testing-gravity.pdf&filename=testing-gravity.pdf)   **Extensions:** **Writing Fun with Gravity**   * Have the students write a story about gravity. Possible topics include:   + “A Day Without Gravity”: What would happen if you woke up to find that the Earth had no gravity? What would you do? What tasks would be easier? What would be harder?   + ”My Battle with Gravity”: Choose an object to be (a ball, a leaf, etc.) and describe the effects that gravity has on you. What is it like to fall to the Earth because of gravity? Describe the experience. * The book *Waking Upside Down* (see book list) can be used as a way to get students thinking creatively about gravity, or the lack of it.   **Family Connections:**   * Challenge the students to design and make a paper airplane that will defy gravity by flying in the straightest and furthest path. * Have the students bring their airplanes to school the next day for test flights. For the remainder of this activity, see “Activity Connected to Lesson” section.   **Assessment Plan:**   * Check to be sure that students have filled in the correct information on their *Gravity*page, *Falling Objects* paper, and *How High Can You Jump?* paper. * Assess students through their participation in class discussions and activities.   Ask the children what keeps the Earth revolving around the sun (Gravity). Demonstrate: Have all but 1 child sit at one side of the room. Have 1 child stand next to you. Hold hands. Tell the child to go and sit with the other children while still holding your hand. Meanwhile, you should spin around in a circle a few times and hold on tightly to his/her hand. Ask: What direction was s/he trying to go? What direction did the s/he go? Why couldn't s/he go straight? What did I represent? (sun) What did s/he represent? (Earth) What did our arms represent? (gravity)  Do Galileo/Pisa experiment to demonstrate effects of gravity. Tell them that Aristotle said that items that weigh more will drop faster. Give each child a baseball, tennis ball or orange and a penny. Have them stand on a chair or someplace higher if possible. Ask, "Which item do you think will land first?" Have them hold out both hands and drop the items at the same time. They should land at the same time. (The higher up from which they drop them, the better this will be demonstrated.) Switch out the penny for a piece of paper. Now ask, "Which item do you think will land first?" Have them drop them at the same time. The ball should land first. Now have them crumple up the paper tightly. Ask, "Which item do you think will land first?" Have them drop them at the same time. They should land at the same time. Ask, "What happened?" Explain that they changed the surface area of the paper. The paper floated lightly through the air at first but after you change the surface area, it can't get caught up in the wind anymore. If our planet was like [Mercury](http://www.squidoo.com/the-sun-and-the-moon-lesson-plan-in-homeschool-astronomy-unit-) or the moon and didn't have an atmosphere, even the un-crumpled paper would fall at the same speed." Show pictures of Galileo's experiment from Galileo's Leaning Tower Experiment by Wendy Macdonald. YOU WILL NEED: 9 baseballs, tennis balls or oranges, 9 pennies, & 9 pieces of paper  One of the most important figures to come out of the awakening world of the Renaissance was Galileo Galelei. Often referred to as the "Archimedes of his time" Galileo was forever asking questions. Is it possible to measure heat? Is it possible to weigh air? Does the earth stand still or does it move? How fast do objects fall to the earth? His questions led to some of the most important answers of the scientific world and to his contributions to astronomy, physics, and mathematics.  In every age there are courageous people who break with tradition to explore new ideas and challenge accepted truths. Galileo Galilei was just such a man--a genius--and the first to turn the telescope to the skies to map the heavens. In doing so, he offered objective evidence that the earth was not the fixed center of the universe but that it and all the other planets revolved around the sun. Galileo kept careful notes and made beautiful drawings of all that he observed. |
| [*Boy, Were We Wrong About the Solar System*](http://www.amazon.com/Were-Wrong-About-Solar-System/dp/0525469796%3FSubscriptionId%3D19BAZMZQFZJ6G2QYGCG2%26tag%3Dsquid1251741-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D0525469796) by: Kathleen V. Kudlinski  [*Moon (Jump Into Science)*](http://www.amazon.com/Moon-Jump-Science-Steve-Tomecek/dp/0792251237%3FSubscriptionId%3D19BAZMZQFZJ6G2QYGCG2%26tag%3Dsquid1251741-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D0792251237) by: Steve Tomecek  [*Eclipse: Darkness in Daytime*](http://www.amazon.com/Eclipse-Darkness-Franklyn-Mansfield-Branley/dp/0690046170%3FSubscriptionId%3D19BAZMZQFZJ6G2QYGCG2%26tag%3Dsquid1251741-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D0690046170) by: Franklyn Mansfield Branley  *What Makes Day and Night* by Franklyn M. Branley.  [Gravity Is a Mystery (Let's-Read-and-Find-Out Science 2)](http://www.amazon.com/Gravity-Mystery-Lets-Read-Find-Out-Science/dp/0064452018?SubscriptionId=19BAZMZQFZJ6G2QYGCG2&tag=squid1251741-20&linkCode=xm2&camp=2025&creative=165953&creativeASIN=0064452018)  [*Gravity Is a Mystery (Let's-Read-and-Find-Out Science 2)*](http://www.amazon.com/Gravity-Mystery-Lets-Read-Find-Out-Science/dp/0064452018%3FSubscriptionId%3D19BAZMZQFZJ6G2QYGCG2%26tag%3Dsquid1251741-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D0064452018) by: Franklyn M. Branley  [Galileo's Leaning Tower Experiment (Junior Library Guild Selection (Charlesbridge Hardcover))](http://www.amazon.com/Galileos-Experiment-Selection-Charlesbridge-Hardcover/dp/1570918694?SubscriptionId=19BAZMZQFZJ6G2QYGCG2&tag=squid1251741-20&linkCode=xm2&camp=2025&creative=165953&creativeASIN=1570918694)[*Galileo's Leaning Tower Experimen*t (Junior Library Guild Selection (Charlesbridge Hardcover)](http://www.amazon.com/Galileos-Experiment-Selection-Charlesbridge-Hardcover/dp/1570918694%3FSubscriptionId%3D19BAZMZQFZJ6G2QYGCG2%26tag%3Dsquid1251741-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D1570918694) by: Wendy Macdonald  [Starry Messenger: Galileo Galilei by Peter S�s](http://www.amazon.com/Starry-Messenger-Galileo-Peter-S%C3%ADs/dp/0374470278?SubscriptionId=19BAZMZQFZJ6G2QYGCG2&tag=squid1251741-20&linkCode=xm2&camp=2025&creative=165953&creativeASIN=0374470278)[Starry Messenger: Galileo Galilei by Peter Sís](http://www.amazon.com/Starry-Messenger-Galileo-Peter-S%C3%ADs/dp/0374470278%3FSubscriptionId%3D19BAZMZQFZJ6G2QYGCG2%26tag%3Dsquid1251741-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D0374470278)   |  | | --- | | The first travel guide to the Moon : what to pack, how to go, and what to see when you get there | |  | **Rhoda Blumberg ; illustrated by Roy Doty.** | |
| Resources  Moon Phases diagram animation that shows the relative positions of the sun, the earth and the moon. <http://www.astro.wisc.edu/~dolan/java/MoonPhase.html>    NASA animation of Phases of the Moon using satellite images  <http://www.solarviews.com/cap/moon/vmoon2.htm>    Today’s phase of the moon (apparent disk of the moon) <http://aa.usno.navy.mil/idltemp/current_moon.html>   Phases of the moon web page <http://www.enchantedlearning.com/subjects/astronomy/moon/Phases.shtml> |